

REMARKS

Applicants have thoroughly considered the Examiner's remarks in the non-final office action mailed October 15, 2004 and respectfully acknowledge the Examiner's indication of allowable subject matter in claims 20-22. Claims 1-23 are now presented in the application for further examination. By this Amendment A, claims 1, 3-5, 20, 22, and 23 have been amended and claims 24 and 25 have been canceled. Reconsideration of the application and claims as amended and in view of the following remarks is respectfully requested. The following remarks will follow the sequence of the Office Action.

Rejections Under 35 U.S.C § 102

Claims 1-25 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,606,300 to Koyama et al. (Koyama). However, "a claim is anticipated only if each and every element as set forth in the claim is found either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631 (Fed. Cir. 1987). Applicants submit that the Koyama patent fails to teach each and every element as recited in the amended claims and, thus, the cited reference does not anticipate the claims.

The present application discloses a high field superconducting magnet for use in, for example, a nuclear magnetic resonance (NMR) spectrometer. In particular, the present invention involves a superconducting magnet that has a plurality of superconducting coils impregnated with epoxy and nested within each other. An innermost one of the nested coils has a relatively wide bore through it (i.e., greater than approximately 100mm). See application page 8, paragraph 25. As recognized by those skilled in the art, magnetic and thermal loads generated during operation of a superconducting magnet can cause stresses within the coils that adversely affect the stability of the magnet. Accordingly, such mechanical stresses, or forces, are an important factor to consider when designing superconductor magnets.

In a cylindrical coil, there are two main components to the mechanical forces in the windings. First, a force in a radially outward direction generally tends to expand the diameter of

the coil. Second, an axial force at each end of the coil toward the center results in a pressure at the midplane of the coil and tends to make the coil shorter. Both of these forces can produce excess mechanical stress on the conductor. Therefore, magnet reinforcement is desired for containing the radial component of the force to limit the radial expansion of the windings as well as containing the axial component of the force to reduce the pressure on the conductor at the center of the coil about the midplane. See application page 3, paragraph 11. Advantageously, the present application discloses winding a conductor (i.e., a superconducting coil) and a reinforcement wire in sequence and then impregnating them together with epoxy in a common epoxy impregnation and cure process. The result is a composite structure that is continuous in the bonding matrix material (i.e., the epoxy and any additional fiber introduced for insulation and reinforcement of the epoxy) even though it contains two types of windings. This coil configuration provides integral external reinforcement of the coil, which in turn promotes mechanical integrity in the axial as well as in the radial directions to sustain the mechanical load imposed on coils. See application page 13, paragraph 58.

To this end, amended claim 1 recites:

A superconducting magnet comprising:

a plurality of superconducting coils, said coils being impregnated with epoxy and nested within each other, an innermost one of the nested coils having a bore therethrough defining a bore width of the magnet, said bore width being greater than approximately 100 millimeters, said nested coils being electrically connected in series and cooled to an operating temperature less than approximately 4 degrees K; and

an integral external reinforcement on at least one of the superconducting coils, said reinforcement being impregnated in the epoxy together with the reinforced at least one of the superconducting coils for providing structural reinforcement to the magnet in both radial and axial directions.

As acknowledged by the Examiner, the Koyama reference does not teach or suggest reinforcement of the coil. See Office action at page 3. Consequently, Koyama cannot anticipate each and every element as recited in amended claim 1, and applicants respectfully request that the anticipation rejection of claim 1 based on this reference be removed.

Claims 2-19 depend from claim 1 and are believed to be allowable over the cited reference for at least the same reasons as the claim from which they depend.

Amended claim 23 recites, in part, "an integral external reinforcement on at least one of the coils, said external reinforcement being impregnated in the epoxy together with the reinforced at least one of the coils for providing structural reinforcement to the magnet in both radial and axial directions." Inasmuch as Koyama fails to teach or suggest each and every element of amended claim 23, including an integral external reinforcement, the cited art does not render claim 23 unpatentable.

Rejections Under 35 U.S.C § 103

Claims 3-8 and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Koyama in view of Japanese Patent No. 58,194,309 A issued to Ito (Ito). Although the Office action acknowledges that the Koyama reference does not disclose reinforcement of the coil, the Examiner asserts that it would have been obvious to one of ordinary skill in the art at the time the invention was made to wrap the coil of Koyama with the reinforcement wire of Ito to prevent the movement of a superconductive wire due to electromagnetic force thereby improving stability. As explained below, the cited references, even when combined as suggested in the Office action, fail to teach or suggest all of the features of applicants' claims. Thus, *prima facie* obviousness has not been established. See MPEP 2142 and 2143.

Ito discloses a superconductive magnet wound on a bobbin. On the outer periphery of the superconductive magnet, a securing band is spirally wound under a high tension. Unlike the integral reinforcement of amended claim 1, the securing band disclosed in Ito is attached to opposite sides of the bobbin, and not integrated with the coils. As described in the present application, a known technique for reinforcing cylindrical magnetic coils involves applying a high strength wire wound into place over the magnetic coil. Although this technique provides strength in the radial direction against the expansion of the hoops formed by the reinforcement winding, it can be weak in the axial direction. See Application, page 4, paragraph 12. Thus, the securing band disclosed in Ito merely describes a conventional, non-integral reinforcement technique that is generally limited to providing structural support in only the radial direction.

Claims 3-8 and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Koyama in view of U.S. Patent No. 6,534,718 issued to Pourrahimi et al. (Pourrahimi). The Office again acknowledges that the Koyama reference does not disclose reinforcement of the coil, but asserts that Pourrahimi discloses a superconducting coil with the coil being wound with a reinforcement wire. Applicants submit the Examiner is mistaken in his interpretation of Pourrahimi, as the cited reference does not teach an *integral external reinforced coil configuration* providing structural reinforcement in both radial and axial directions as claimed and described in the present application.

Upon review of the reference, applicants submit that Pourrahimi does not qualify as prior art under any section of 35 U.S.C § 102. The present application is a divisional application of application Serial No. 09/668,992, filed September 25, 2000, which claims the benefit of provisional application Serial No. 60/156,081, filed September 24, 1999. Accordingly, the Pourrahimi patent, which has an effective filing date of January 30, 2001, does not antedate the present application and, thus, does not qualify as prior art.

Nevertheless, Pourrahimi merely discloses surrounding a multifilament composite wire with stainless steel reinforcing material (i.e., a steel sheath) before it is wound into a coil. In particular, Pourrahimi discloses a composite wire of a given diameter and length is clad by a given layer of steel by folding and welding a continuous sheet of the steel. See column 5, lines 6-10. Surrounding a wire with a sheath is not the same as impregnating a coil together with an external reinforcement winding to form an integral reinforcement.

In contrast to the cited art, whether considered separately or together, the invention of amended claim 1 includes, in part, "an *integral external reinforcement* on at least one of the superconducting coils, *said reinforcement being impregnated in the epoxy together with the reinforced at least one of the superconducting coils for providing structural reinforcement to the magnet in both radial and axial directions*. In view of the foregoing, applicants submit that the cited art fails to teach or suggest each and every element of claim 1, including an integral external reinforcement. Therefore, claim 1 is allowable over the cited references.

Claims 2-19 depend from claim 1 and are believed to be allowable for at least the same reasons as the claim from which they depend.

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Amended claim 23 recites, in part, "an integral external reinforcement on at least one of the coils, said external reinforcement being impregnated in the epoxy together with the reinforced at least one of the coils for providing structural reinforcement to the magnet in both radial and axial directions." As explained above, the cited art fails to teach or suggest this element of claim 23. For this reason, applicants believe claim 23 to be allowable over the prior art.

Allowable Subject Matter

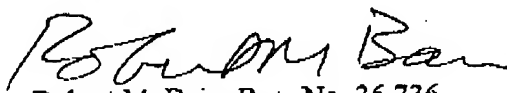
Applicants respectfully acknowledge the Examiner's indication of allowable subject matter in claims 20-22. See Office action at page 7. As suggested by the Examiner, applicants have rewritten claims 20 and 22 in independent form, including all the limitations of the base claim and any intervening claims. Claim 21 depends from claim 20 and is therefore allowable for at least the same reasons as claim 20.

It is felt that a full and complete response has been made to the Office action, and applicants respectfully submit that claims 1-23 are in condition for allowance. If the Examiner feels, for any reason, that a personal interview will expedite the prosecution of this application, he is invited to telephone the undersigned.

The fact that applicants may not have specifically traversed any particular assertion by the Office should not be construed as indicating applicants' agreement therewith.

Any required fees or overpayments should be applied to Deposit Account No. 19-1345.

Respectfully submitted,



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